KEEP IT CLEAN

PRINCIPLES OF CLEAN CUTTING FOR WOODTURNERS

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1. SHARP TOOLS

- Principle: Sharp tools can give clean cuts, dull tools can't. None of the other principles matter much is the tool isn't sharp--first, check the tool.
- Examples: Beginners tend to resist sharpening tools.
- Application: Have you ever tried using a dull tool. Try it (once), you won't like it. There is no substitute for sharp tools.

2. GRAIN DIRECTION

- Principle: Fibers being cut must be supported by other fibers
- Examples:
  -Jointing routing or planing endgrain, drilling through wood with no support below.
- Applications:
  -When spindle turning cut 'down hill", from large to small diameter (vees, coves, beads, tapers).
  -When turning inside of endgrain boxes or goblets, cut small to large diameter.
  -When turning bowls cut into side grain rather than into endgrain.

3. ANGLE OF BEVEL

- Principle: The longer the angle the finer the cut.
- Examples: Bench plane 30 degrees, block planes 20 degrees and low angle planes, cabinet scraper 45 degrees (burr), detail gouge 40-45 degrees, roundnose scraper 60-80 degrees (burr).
- Applications: For finer, lighter cuts, grind tool to a longer angle. Note longer angles require more skill to grind, and lose their edge more quickly.

4. KEEP THE BEVEL IN CONTACT WITH THE WOOD

- Principle: The depth of cut is controlled by rubbing the bevel on the wood just behind the cutting edge. (This principle is somewhat unique to turning and carving and does not apply generally to tool geometry for machining processes.)
- Examples: Try making a controlled cut with a carving gouge without the bevel contacting the wood. You will see up close and in slow motion the lack of control and poor cut that results.
- Application: Start the cut safe by rubbing the heel of the bevel on the wood and then lift and/or rotate the tool into the wood to pick up a shaving. As you advance the tool while making a cut, notice what happens as you pivot the tool too far toward the cutting edge (toe of the bevel) (the tool digs in and cuts a backward spiral), and too far away from the cutting edge (toward the heel of the bevel) (you lose the shaving and get no cut).

5. APPROACH ANGLES

- Principle: The approach angle determines scraping or shearing. When making curved cuts such as beads and coves, it is necessary to move the tool in three controlled and coordinated arcs in order to keep the bevel rubbing, control the depth of cut, and create a smooth curve. These thee arcs, which control the approach angle are noted below.

a.) Vertical--Up to down or down to up. (For shearing cuts we do not want the vertical angle to be at 90 degrees so we lower the tool handle.)

- Example: Low angle bench planes 12 degrees rather than 30 degrees.
- Application: When cutting a bead, the tool handle will begin low and will be raised as we approach the end of the cut. When cutting a cove the tool handle will be begin high and will be lowered toward the end of the cut

b.) Horizontal / Lateral: Side to side. (Again, for shearing cuts we do not want the vertical angle to be at 90 degrees, so we swing the handle to the left or right.)
- Example: Skewing hand plane away from 90 degrees.
- Application: When cutting a bead the tool handle will begin at 45 -60 degrees to the wood and at the end of the cut will be closer to 90 degrees.

c.) Rotational--Rotating or rolling the tool clockwise or counterclockwise
- Application: When cutting a bead, the flute is near the 12:00 (o'clock) position at the beginning of the cut and near the 9:00 or 3:00 position at the end of the cut. When cutting a cove the flute will start out near the 9:00 or 3:00 position and be rotated toward the 12:00 position at the end of the cut.
- Application of controlling the three arcs: When turning beads and coves, try to be aware of making each of the three arcs independent of each other as well as coordinated into one motion.

6. EXIT OF SHAVINGS
- Principle 1: The quality of the cut is directly related to how little the shavings have to change direction as they are removed from the workpiece.
- Example: Note scraping angle versus shearing angle.
- Application: Experiment with a gouge to see how changing an approach angle from 90 degrees to 30-45 degrees impacts both the quality of the shaving and the cut.
- Principle 2: Shavings must have a clear path to exit the workpiece.
- Examples: Gullet in saw blades, flutes in drill bits, throat opening and chip breaker on hand planes, window in hollow chisel mortising bit.
- Application: Clean vee cuts require making at least three cuts. Cutting a vee before cutting a bead allows for removal of shavings and clearance for the tool.

7. CLEARANCE FOR THE CUTTING TOOL
- Principle: There must be clearance for the cutting tool to prevent friction and binding.
- Examples: "Set" in saw blades. Tapers on parting tool.
- Application: Deep parting tools cuts require that successive cuts be made to keep the cut wider than the body of the tool. An extreme application of this is required when coring out nested bowls.

8. AMOUNT OF CUTTING EDGE CONTACTING THE WORKPIECE
- Principle: When less of the cutting edge is contacting the wood a finer cut results.
- Examples: Scissors, paper cutter, helical surface planer or machining head, old fashion lawn mower.
- Application: When turning, experiment with changing the width of the shaving. Generally you will find that cuts that produce narrow shavings also produce finer surfaces.

9. FEED SPEED (along the axis and toward the axis)
- Principle (along the axis): The faster the feed the rougher the cut. This impacts the spacing of tool marks.
- Principle (toward the axis): The heavier the cut the rougher the surface. This impacts the thickness of shavings.
- Examples: Watch an experienced turner and notice how rough cuts are made very aggressively and finish cuts are made with much slower feed speeds. (The "thundering velvet hand".)

10. STABILITY OF THE TOOL
- Principle: Stable tools produce a finer more controlled cut with little vibration.
- Examples: Double plane iron and plane iron cap to support plane iron, "long and strong" turning tools
- Application: Notice how the control of the cut is impacted by both the stability of the tool and the distance the tool rest is from the cut.